Lindsay Creek
Monitoring Report 2002

Collection period (2/27/01 to 2/25/02)

Developed for:

Nez Perce Soil and Water Conservation District
Idaho Soil Conservation Commission
Idaho State Department of Agriculture

Prepared by:

Cary Myler
Water Quality Analyst
Idaho Association of Soil Conservation Districts
Moscow, Idaho 83843

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Technical Results Summary CDM-LZ-02

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Executive Summary

Water quality monitoring was performed on Lindsay Creek (LZ) by the Idaho Association of Soil Conservation Districts (IASCD) from February 27, 2001 to February 25, 2002. Six sites were selected to represent the LZ watershed with water quality sampling occurring every two weeks. Laboratory analysis of N, P, and total suspended solids was performed by University of Idaho, Analytical Science Laboratories and bacteria samples were analyzed by Anatek Laboratories. Parameters measured were total suspended solids (TSS), nitrate+nitrite (NO_3+NO_2), total phosphorus (TP) and ortho-phosphate (OP). Other measurements include stream discharge, pH, specific conductance (Cond), total dissolved solids (TDS), dissolved oxygen (DO), % saturation (% Sat), turbidity (turb), and temperature (temp). The data generated from this monitoring program will be used by IASCD, Soil Conservation Commission (SCC), and the Nez Perce Soil and Water Conservation District (NPSWCD) to determine loads within the stream, identify areas where best management practices (BMPs) would have the greatest benefit, provide baseline data prior to TMDL development, and identify changes as BMPs are implemented.

All measured values for dissolved oxygen, water temperature, and pH were all observed to be within the acceptable range of standards during the monitoring period. With the exception of one isolated event, very little sediment entered Lindsay Creek from agriculture during the monitoring period. Significant positive correlations were observed between TSS and Turbidity versus Total Phosphorus at all mainstream sites (LZ-1, LZ-3, LZ-5, and LZ-6), which suggests that at least some phosphorus is being mobilized by the release of sediment at these locations. However, TSS concentrations, except for one or two exceptions remained well within acceptable boundaries. At sites LZ-2 and LZ-4 the data suggest that phosphorus could be entering the water column from observed cattle and horse grazing and possibly from septic system failures.

Nitrate+Nitrite concentrations at Lindsay Creek were extremely high. Site LZ-2 seems to be a major contributor with NO_3+NO_2 values averaging just below 6 mg/L. The LZ-2 tributary parallels Lapwai Creek Road. The high NO_3+NO_2 concentrations at this site suggest that septic systems could be failing in this area. There also are several small ranchettes that graze horses in the stream that could be possible contributors. Nitrogen concentrations at LZ-3 seem to be acting as a conduit for nitrogen entering from the LZ-4 and LZ-5 subwatersheds. Baseflow in Lindsay Creek is supported almost entirely from groundwater upwelling. Sites LZ-4 and LZ-5 are located downstream of the most significant upwelling zones. These data suggest that NO_3+NO_2 is entering Lindsay Creek from the groundwater. All Lindsay Creek monitoring stations had several events where bacteria levels for *E. coli* and fecal coliform greatly exceeded the recommended standards. This monitoring program identified nitrates and bacteria as the most serious water quality issue affecting this stream.

Introduction

Lindsay Creek is a small watershed with 7.35 stream miles flowing northeast through dryland agriculture and the eastern urban area of the City of Lewiston. Small residences are located within the watershed to provide a sub-urban aspect to the drainage. Lindsay Creek is listed on the Idaho 303(d) list for bacteria, dissolved oxygen, nutrients, sediment, temperature, habitat alterations, and flow alteration. The TMDL for Lindsay Creek is due 2003. This monitoring program collected data to address bacteria, dissolved oxygen, nutrients, sediment, temperature and concerns surrounding these water quality parameters.

Monitoring Program

Water quality monitoring was performed on Lindsay Creek (LZ) by the Idaho Association of Soil Conservation Districts (IASCD) from February 27, 2001 to February 25, 2002. Six sites were selected to represent the LZ watershed (Figure 1) with water quality sampling occurring every two weeks. Laboratory analysis of nitrogen (N), phosphorus (P), and total suspended solids (TSS) was performed by University of Idaho, Analytical Science Laboratories (UIASL) and bacteria samples were analyzed by Anatek Laboratories. Parameters measured were total suspended solids, nitrate+nitrite (NO_3+NO_2), total phosphorus (TP) and ortho-phosphate (OP). Other measurements include stream discharge, pH, specific conductance (Cond), total dissolved solids (TDS), dissolved oxygen (DO), % saturation (% Sat), turbidity (turb), and temperature (temp). The data generated from this monitoring program will be used by IASCD, Soil Conservation Commission (SCC), and the Nez Perce Soil and Water Conservation District (NPSWCD) to determine loads within the stream, identify areas where best management practices (BMPs) would have the greatest benefit, provide baseline data prior to TMDL development, and identify changes as BMPs are implemented.

Site Descriptions

1. Site located near the mouth of Lindsay Creek within Odom Company's private park.
2. Site located near mouth of tributary, which parallels Lapwai Creek Rd.
3. Site located below feedlot along Lindsay Creek Road.
4. Site located upstream of confluence with Lindsay Creek on the unknown tributary.
5. Site located upstream of confluence between Lindsay Creek and unknown tributary.
6. Site located on outlet of Mann Reservoir.

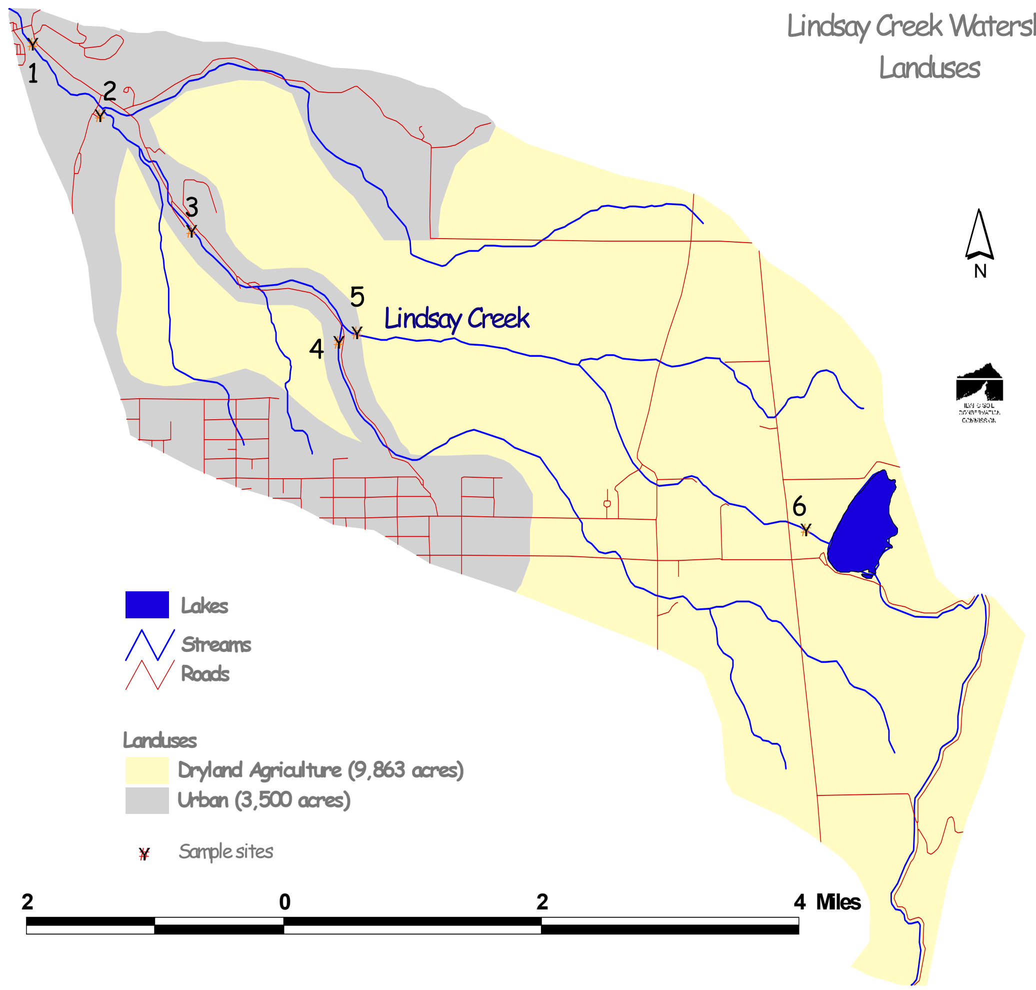

Figure 1. Map of the Lindsay Creek Watershed with IASCD monitoring sites.

Methods

Water Quality

A representative depth-integrated sample was collected at each site by collecting approximately 4 liters of stream water. Water samples were collected with a one-liter Nalgene bottle and transferred into a 2.5-gallon polyethylene churn sample splitter. The polyethylene churn splitter was rinsed with ambient water at each location prior to sample collection. The resultant composite sample was homogenized before filling the appropriate sample containers. Ortho-phosphate samples were filtered through a 0.45 μm GN-6 Gelman metricel filter. The resultant filtrate was transferred directly into the appropriate sample bottle. The filtration unit was thoroughly rinsed with deionized water and equipped with a new 0.45 μm filter at each sampling location. Water samples requiring preservation (Table 1) were transferred into preserved (H_2SO_4 pH <2) 500 mL sample containers. Water quality samples (TSS, NO_2+NO_3, TP, and OP) were analyzed at UIASL in Moscow, Idaho.

Bacteriological samples (fecal coliform and *Escherichia coli* (*E. coli*)) were collected directly from the thalweg into sterile sample containers. The samples were shipped to Anatek Labs in Spokane, Washington for analysis. Most probable number (MPN) multiple tube fermentation was used to determine bacteria levels in the water sample.

Table 1 displays a list of parameters, sample sizes, preservation, holding times, analytical methods. All sample containers were labeled with waterproof markers with the following information: station location, sample identification, date of collection, and time of collection. Samples were placed on ice and transported to the laboratory the same day as collection. Chain-of-custody forms accompanied each sample shipment.

Table 1. Water Quality Parameters

Parameters	Sample Size	Preservation	Holding Time	Method
Non Filterable Residue (TSS)	1L	Cool 4°C	7 Days	EPA 160.2
Nitrogen(NO_3+NO_2)	60 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 353.2
Total Phosphorus	100 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 365.4
Ortho Phosphate	100 mL	Filtered , Cool 4°C	24 Hours	EPA 365.2
Fecal Coliform	100 mL	Cool 4°C	30 Hours	SM9221
Escherichia coli	100 mL	Cool 4°C	30 Hours	MPN

Field Measurements

At each location, field parameters for dissolved oxygen, specific conductance, pH, temperature, turbidity, and total dissolved solids were measured. Calibration of all field equipment will be in accordance with the manufacturer's specifications. Table 2 contains a listing of field measurements, equipment and calibration techniques.

Table 2. Field Measurements

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI Model 55	Ambient air calibration
Temperature	YSI Model 55	Centigrade thermometer
Conductance & TDS	Orion Model 115	Specific Conductance ($25^{o}C$ standard)
pH	Orion Model 210A	Standard buffer (7,10) bracketing for linearity
Turbidity	Hach Model 2100P	Formazin Primary Standard

All field measurements were recorded in a field notebook along with any pertinent observations about the site, including weather conditions, flow rates, personnel on site, and any problems observed that might affect water quality.

Stream Discharge Measurements

Flow measurements were collected at each site using a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenths depth method (0.6 of the total depth from the surface of the water surface) was used. At each monitoring station, a transect line was established across the width of the drain/creek at an angle perpendicular to the flow for the calculation of cross-sectional area. The discharge was computed by summing the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. Stream discharge was reported as cubic feet per second (cfs).

Quality Assurance and Quality Control (QA/QC)

The UIASL utilizes methods approved and validated by the Environmental Protection Agency (EPA). A method validation process, including precision and accuracy performance evaluations and method detection limit studies, are required of ASL Standard Methods. Method performance evaluations include quality control samples, analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are part of UIASL's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project included a duplicate and a blank sample (one set per sampling day). The field blanks consisted of laboratory-grade deionized water, transported to the field and poured off into the appropriate sample container. The blank sample was used to determine the integrity of the field teams handling of samples, the condition of the sample containers and deionized water supplied by the laboratory, and the accuracy of the laboratory methods. Duplicates were obtained by filling two sets of sample containers with homogenized composite water from the same sampling site. The duplicate and blank samples were not identified as such to laboratory personnel to ensure laboratory precision.

Data Handling

All of the field and analytical data generated from each survey was reviewed and submitted to ISDA for review. Each batch of data from a survey was evaluated to insure that all necessary observations, measurements, and analytical results have been properly recorded. The analytical results were reviewed for completeness and accuracy. Any suspected errors were investigated and resolved, if possible. The data were then be stored electronically and are available to any interested entity.

Results and Discussion

Descriptive data is presented in Table 3. This table includes maximum, minimum, and average values for each measured parameter as well as the number and percentage of sampling events that exceeded state water quality standards and EPA criteria.

Dissolved Oxygen

The State of Idaho standard for DO states that dissolved oxygen must exceed 6.0 mg/L at all times for cold water biota. All measured dissolved oxygen concentrations at every site were well above the recommended state standard (Figure 2, Table 3).

Water Temperature

The State of Idaho water quality standard for temperature support of cold water biota is less than 22^{o}C. No exceedance of instantaneous water temperature was observed at any Lindsay Creek monitoring station during the monitoring period (Figure 3, Table 3). The stability of water temperature in this stream is probably directly attributed to significant ground water influence.

Specific Conductance and Total Dissolved Solids

No standards or criteria exist that set limits of conductance or TDS. Specific conductance and TDS measurements that were performed during the sampling period were all observed to be extremely high compared to the typical range of values for the Idaho Panhandle (Figure 4, Table 3). Saline and alkaline soils are both present in this area and could explain the high conductivity results. In addition, specific conductance data collected from the Tammany Creek watershed were similar to Lindsay Creek, which supports geologic makeup of the area as the reason for such high values.

pH

The State of Idaho water quality standard for pH states that H^+ concentration must fall between 6.5 and 9.5. All measured pH values during the sampling period were observed to be within the acceptable range (Figure 5, Table 3).

Turbidity and Total Suspended Solids

The State of Idaho water quality standard for Turbidity states that measurements should not exceed 25 NTU for more than 10 consecutive days. No numerical standard exists for TSS, but significant direct associations ($p<0.001$) were found between the two measurements at all sites.

Table 1. Maximum, minimum, median, and average values for each measured parameter at IASCD Upper Lapwai Creek Monitoring locations. # exceedance/ year equals the number of sampling events when each respective value exceeded EPA or State of Idaho water quality standards and critera. % exceedance equals the percentage of sampling events when each respective value exceeded EPA or State of Idaho water quality standards and critera.

LZ-1	D.O.	% Sat	Temp	Cond	TDS	pH	Turbidity	TSS	NO_3 -NO_2	TP	OP	F-Coli	E-Coli	Flow
Maximum	12.5	118%	15.8	1556.0	852.0	8.8	545.0	340.0	7.4	1.1	0.3	9000.0	9000.0	6.0
Minimum	9.1	82%	5.1	794.0	422.0	6.9	4.7	9.0	1.3	0.1	0.1	40.0	20.0	2.1
Average	10.8	97%	10.5	1219.5	644.1	8.2	36.0	48.8	6.0	0.2	0.1	1565.0	1331.9	3.6
Median	10.9	96%	10.2	1241.5	668.5	8.3	11.3	30.0	6.1	0.2	0.1	550.0	500.0	3.5
# exceedance	0.0		0.0			0.0	6.0		26.0	25.0	12.0	13.0	23.0	
% exceedance	0%		0%			0%	23%		100%	96%	46%	50%	88%	

LZ-2	D.O.	% Sat	Temp	Cond	TDS	pH	Turbidity	TSS	NO_3 -NO_2	TP	OP	F-Coli	E-Coli	Flow
Maximum	11.6	100%	18.2	1797.0	972.0	8.5	58.3	63.0	8.2	0.6	0.4	16000.0	16000.0	0.6
Minimum	7.1	70%	1.0	882.0	478.0	7.3	3.1	0.0	0.8	0.1	0.0	500.0	80.0	0.0
Average	9.5	85%	10.3	1415.8	749.1	8.2	16.3	22.8	5.6	0.2	0.2	9711.5	6313.8	0.2
Median	9.4	86%	9.1	1469.0	791.0	8.2	13.3	18.5	5.9	0.2	0.2	16000.0	4250.0	0.1
# exceedance	0.0		0.0			0.0	4.0		26.0	25.0	18.0	25.0	25.0	
% exceedance	0%		0%			0%	15%		100%	96%	69%	96%	96%	

LZ-3	D.O.	% Sat	Temp	Cond	TDS	pH	Turbidity	TSS	NO_3 -NO_2	TP	OP	F-Coli	E-Coli	Flow
Maximum	11.9	117%	17.6	1327.0	709.0	8.8	940.0	740.0	6.8	1.7	0.3	16000.0	16000.0	5.2
Minimum	8.1	63%	5.2	518.0	285.0	8.2	3.0	4.0	1.0	0.1	0.1	230.0	60.0	1.0
Average	10.4	94%	11.0	996.1	527.5	8.5	53.6	69.5	5.1	0.2	0.1	3570.8	2335.4	2.4
Median	10.4	95%	9.9	1010.0	558.5	8.5	16.0	33.0	5.4	0.2	0.1	800.0	750.0	2.1
# exceedance	0.0		0.0			0.0	5.0		26.0	22.0	7.0	15.0	25.0	
% exceedance	0%		0%			0%	19%		100%	85%	27%	58%	96%	

LZ-4	D.O.	% Sat	Temp	Cond	TDS	pH	Turbidity	TSS	NO_3 -NO_2	TP	OP	F-Coli	E-Coli	Flow
Maximum	13.1	125%	16.5	2320.0	1280.0	8.9	26.9	22.0	11.0	0.4	0.4	5000.0	5000.0	0.6
Minimum	7.6	77%	5.2	1132.0	609.0	7.8	1.6	0.0	2.2	0.1	0.1	20.0	20.0	0.1
Average	10.1	91%	10.7	1746.7	937.0	8.4	5.6	6.2	8.4	0.2	0.2	575.4	494.2	0.3
Median	10.0	89%	9.8	1986.0	1035.0	8.5	3.5	6.0	8.8	0.2	0.2	95.0	60.0	0.3
# exceedance	0.0		0.0			0.0	1.0		26.0	26.0	22.0	3.0	12.0	
% exceedance	0%		0%			0%	4%		100%	100%	85%	12%	46%	

LZ-5	D.O.	% Sat	Temp	Cond	TDS	pH	Turbidity	TSS	NO_3 -NO_2	TP	OP	F-Coli	E-Coli	Flow
Maximum	12.0	118%	15.7	946.0	514.0	8.6	417.0	260.0	5.3	0.8	0.2	5000.0	5000.0	2.4
Minimum	7.1	67%	6.6	362.0	193.0	8.1	3.3	0.0	0.8	0.0	0.0	20.0	20.0	0.9
Average	10.0	92%	11.5	680.0	357.3	8.4	28.9	33.8	3.7	0.1	0.1	667.7	518.8	1.4
Median	10.1	92%	11.6	751.0	392.0	8.4	13.2	25.0	4.1	0.1	0.1	265.0	210.0	1.3
# exceedance	0.0		0.0			0.0	3.0		26.0	9.0	1.0	6.0	16.0	
% exceedance	0%		0%			0%	12%		100%	35%	4%	23%	62%	

LZ-6	D.O.	% Sat	Temp	Cond	TDS	pH	Turbidity	TSS	NO_3 -NO_2	TP	OP	F-Coli	E-Coli	Flow
Maximum	10.8	94%	19.0	613.0	318.0	8.5	244.0	910.0	0.5	1.4	0.1	5000.0	5000.0	0.2
Minimum	6.2	55%	2.6	304.0	162.0	7.3	4.2	4.0	0.0	0.1	0.1	20.0	20.0	0.0
Average	8.5	75%	10.6	471.5	244.8	7.8	20.8	61.2	0.3	0.2	0.1	982.7	928.8	0.1
Median	8.3	76%	9.7	484.5	260.0	7.8	9.5	20.5	0.3	0.2	0.1	200.0	200.0	0.1
# exceedance	0.0		0.0			0.0	2.0		13.0	24.0	6.0	8.0	16.0	
% exceedance	0%		0%			0%	8%		50%	92%	23%	31%	62%	

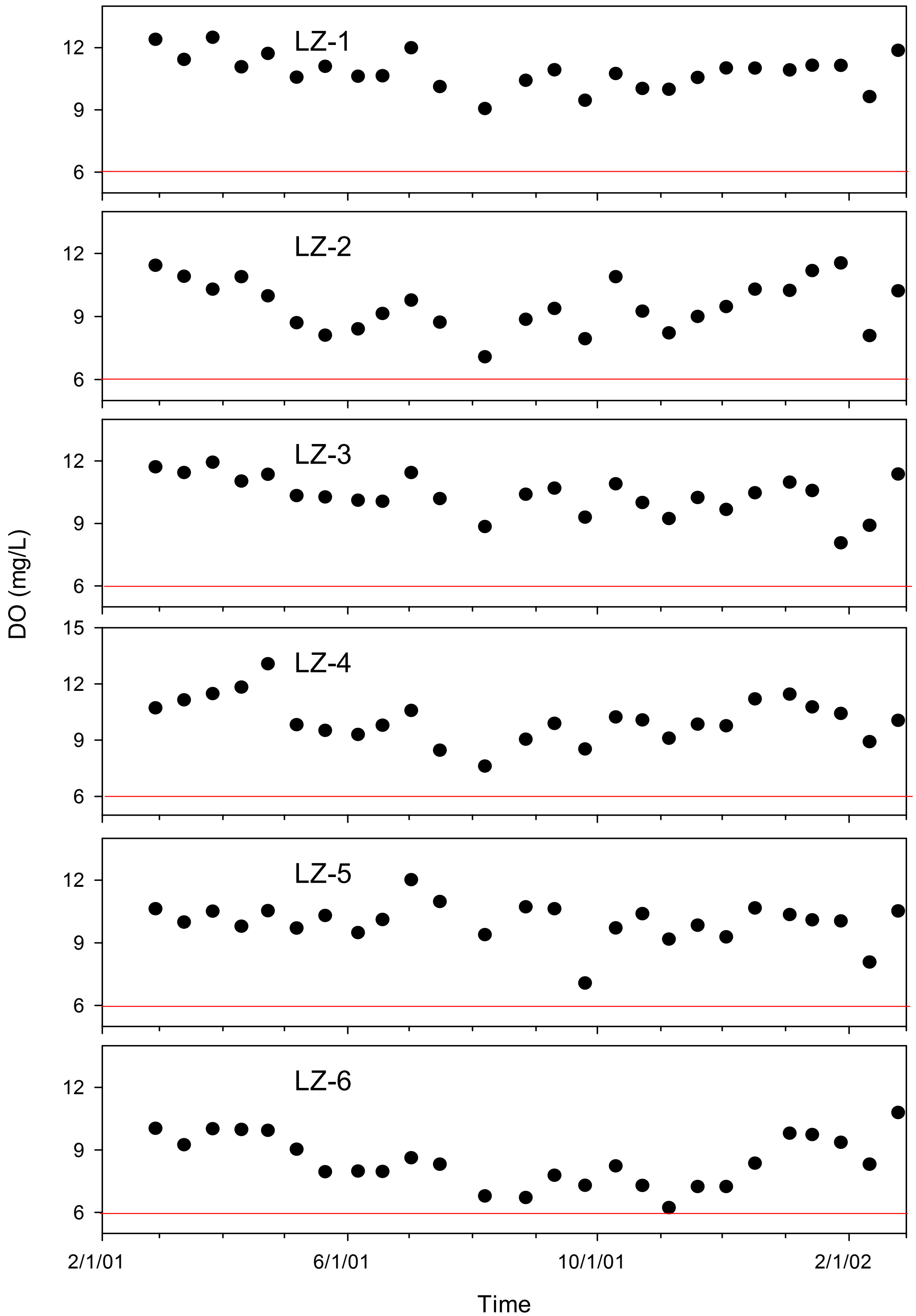

Figure 2. Dissolved oxygen data for Lindsay Creek collected Feb 27, 2001 to Feb 25, 2002.

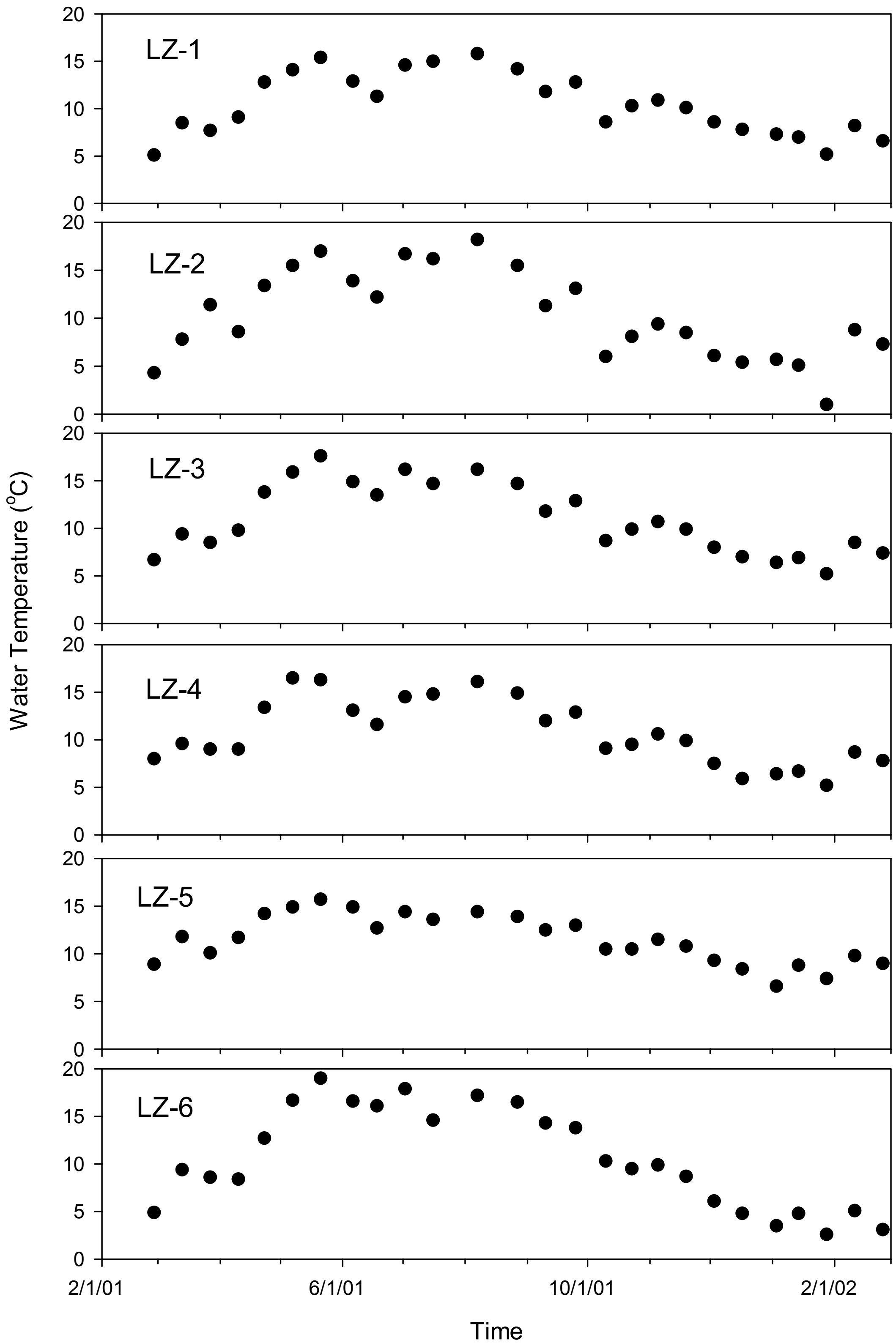

Figure 3. Water temperature data collected from Feb 27, 2001 to Feb 25, 2002 in the Lindsay Creek Watershed.

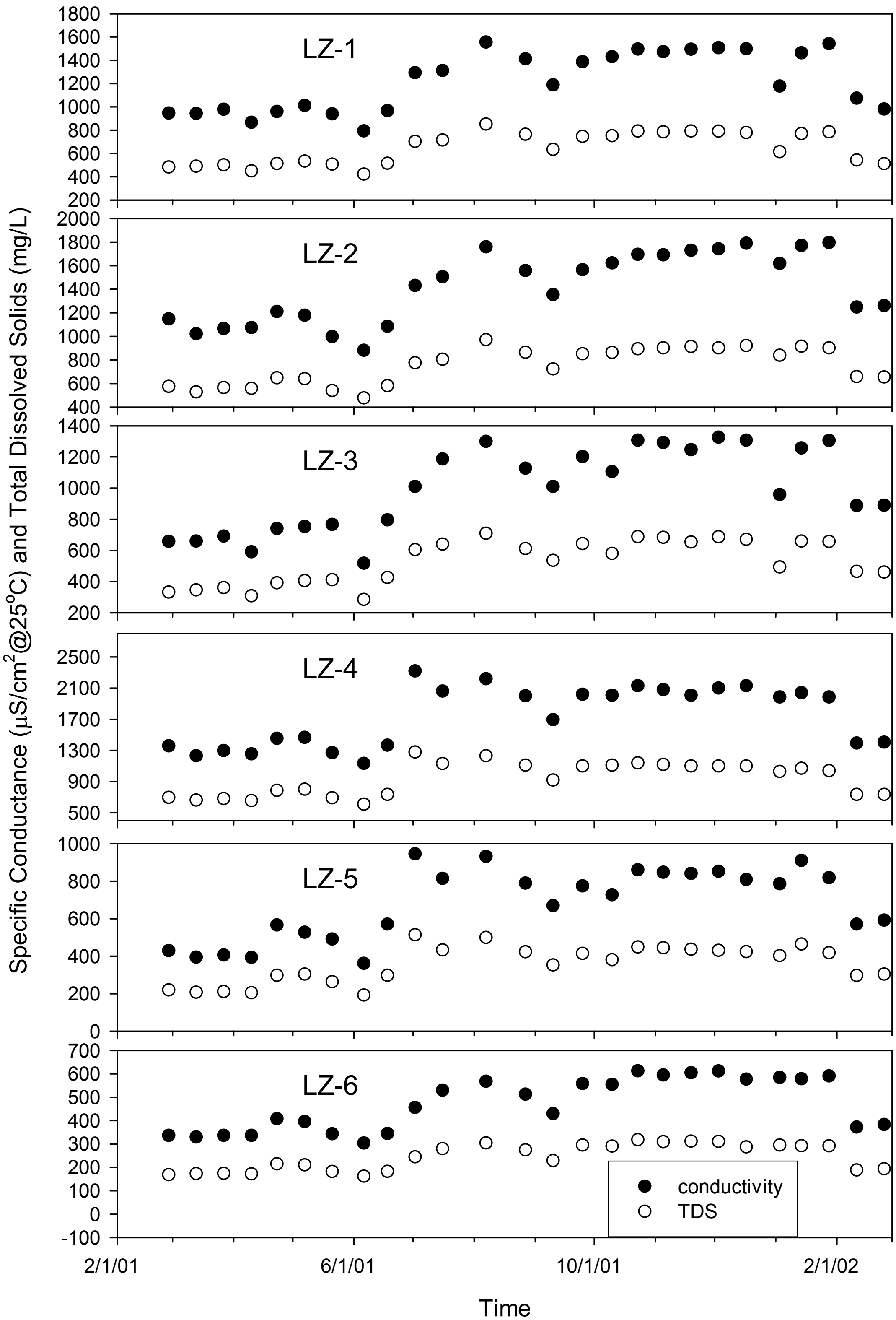

Figure 4. Specific conductance and Total Dissolved Solids collected at Lindsay monitoring sites from Feb 27, 2001 to Feb 25, 2002.

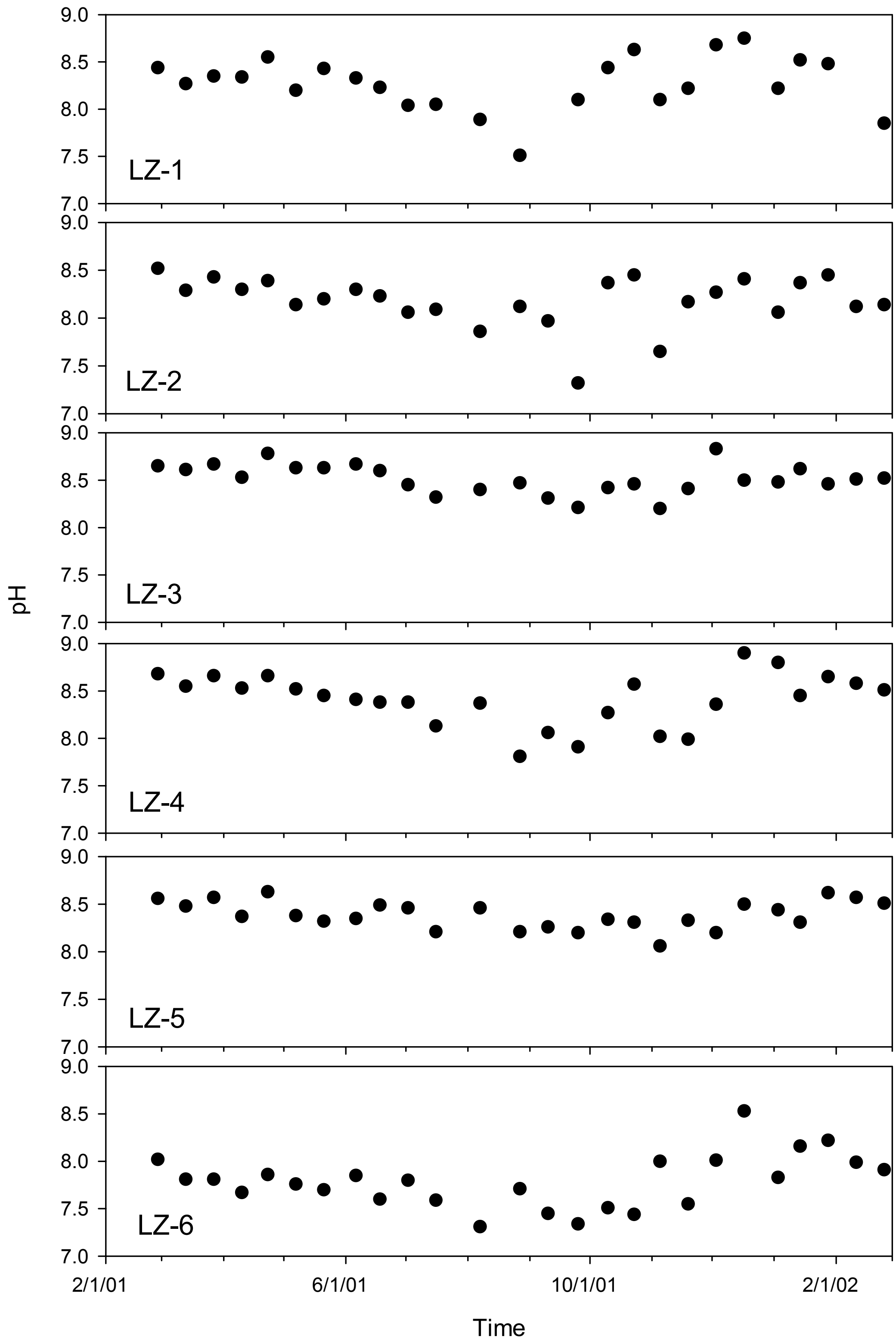

Figure 5. pH data collected at Lindsay Creek from Feb 27, 2001 to Feb 25, 2002.

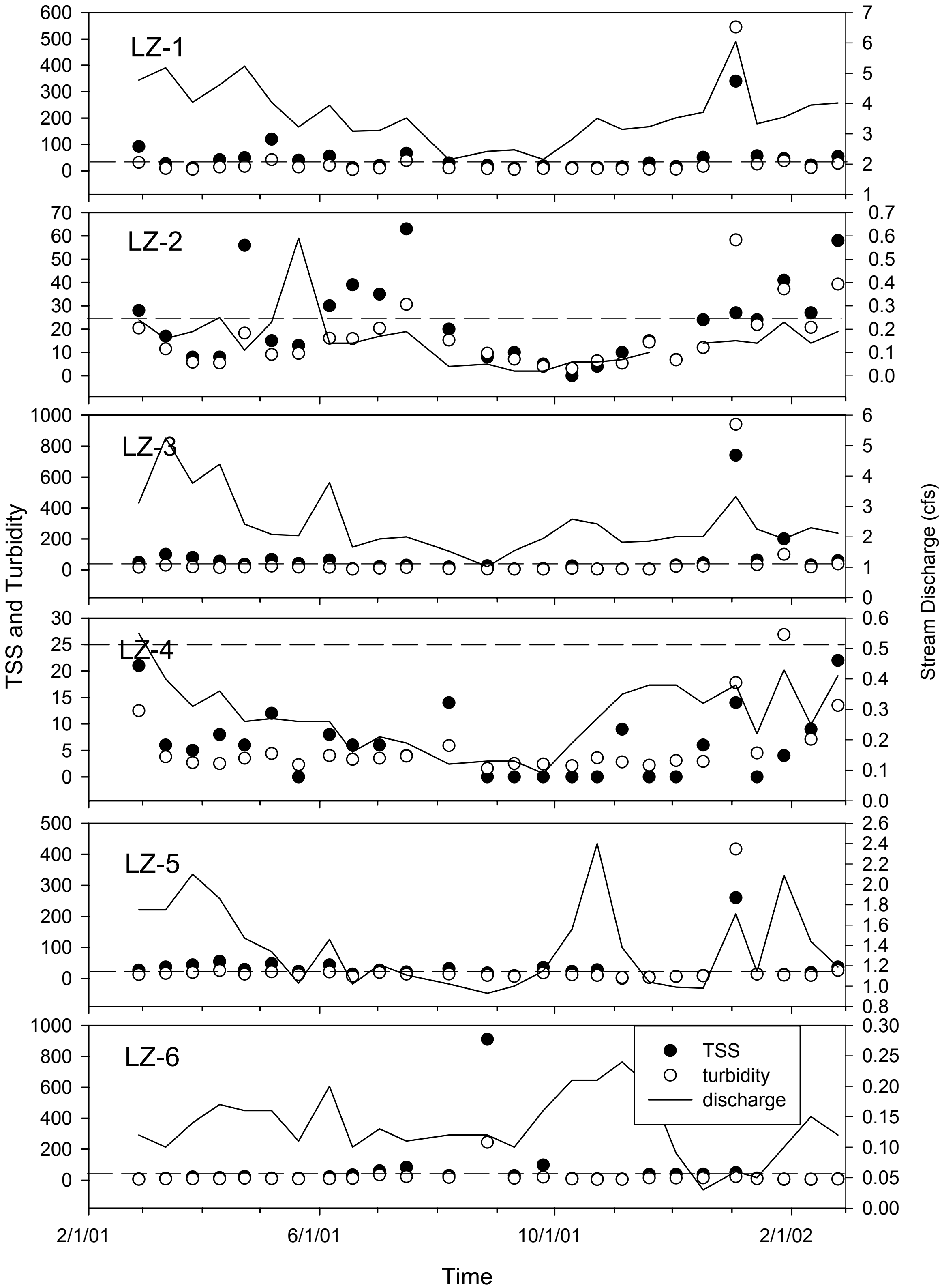

Figure 6. Total suspended solids (TSS), turbidity, and stream discharge data collected at IASCD monitoring locations from Feb 27, 2001 to Feb 25, 2002.

In addition significant direct correlations ($p<0.05$) were between TSS and stream discharge at all mainstem Lindsay Creek sites (LZ-1, LZ-3, LZ-4, and LZ-5). Turbidity and TSS were very low at all sites throughout the year, with one exception at LZ-1, LZ-3, and LZ-5 from a specific field upstream of LZ-5 that experienced heavy tilling just before a major rain event (Figure 6, Table 3). In addition there was an isolated event at LZ-6 where large quantities of organic matter was observed in the stream, which probably resulted from cattle entering the stream upstream of this site (Figure 6, Table 3). Overall, it appears that very little sediment entered Lindsay Creek from agriculture during the monitoring period.

Nitrogen (NO_3+NO_2)

The EPA Gold Book warns that nitrate values in excess of 10 mg/L could be hazardous to young infants if ingested. The literature suggests that NO_3 values in excess of 0.30 mg/L could contribute to excessive plant production and eutrophication in surface water. All measured values at sites LZ-1, LZ-2, LZ-3, LZ-4, and LZ-5 exceeded the recommended nitrogen criterion for surface water (Figure 7, Table 3). Nitrate+Nitrite concentrations at LZ-1 represent a collective value that this watershed discharges into the Clearwater River. Site LZ-2 seems to be a major contributor with NO_3+NO_2 values averaging just below 6 mg/L (Figure 3, Table 7). The LZ-2 tributary parallels Lapwai Creek Road. Lewiston City sewer services do not extend to that area, which indicates that private septic systems are all that are available to residents. The high NO_3+NO_2 concentrations at this site suggest that septic systems could be potentially failing in this area (Figure 7, Table 3). There are also several small ranchettes that pasture horses near this tributary that also could be potential contributors. Nitrogen concentrations at LZ-3 seem to be acting as a conduit for nitrogen entering from the LZ-4 and LZ-5 subwatersheds. There are ranchettes upstream of LZ-3 that have horses and some cows that could potentially contribute to these high levels. Baseflow in Lindsay Creek is supported almost entirely from groundwater upwelling. Sites LZ-4 and LZ-5 are located downstream of the most significant upwelling zones. There are only two private residences on both of these watersheds and it would be unlikely that this number of homes could contribute to values shown in Figure 7. These data suggest that NO_3+NO_2 is entering Lindsay Creek from the groundwater. The Lewiston Orchards development was built just above the headwaters of site LZ-4. It is a possibility that nitrogen based contaminant could be leaking into the ground water and then upwelling at the headwaters of the LZ-4 tributary.

Phosphorus (Total Phosphorus and Ortho-Phosphate)

Ortho-phosphate refers the dissolved or soluble portion of particles less than 0.45 μm. Total phosphorus refers to the total amount of P suspended in the water column (<0.45 and greater). The EPA Gold Book criterion for total phosphorus concentrations is 0.100 mg/L for streams and rivers not discharging directly into lakes or reservoirs. At sites LZ-1, LZ-2, and LZ-4, 100% of total phosphorus concentrations exceeded the recommended criterion (Figure 8, Table 3). At site LZ-1, TP concentrations averaged 0.20 mg/L with a median of 0.15 mg/l (Table 3). At site LZ-2, TP concentrations maintained around 0.2 mg/L and were then elevated to around 0.3 from mid-June to October (Figure 8). Site LZ-3 had a median value of 0.16 mg/L with 88% of the samples exceeding the recommended standard (Figure 8, Table 3). TP concentrations were elevated to 0.3 in July and were also elevated from October to May (Figure 8). LZ-5, which is the site below agricultural landuses had the lowest TP values in Lindsay Creek with a median value of 0.09 mg/L (Figure 8, Table 3). Site LZ-6 was consistent throughout the year (around

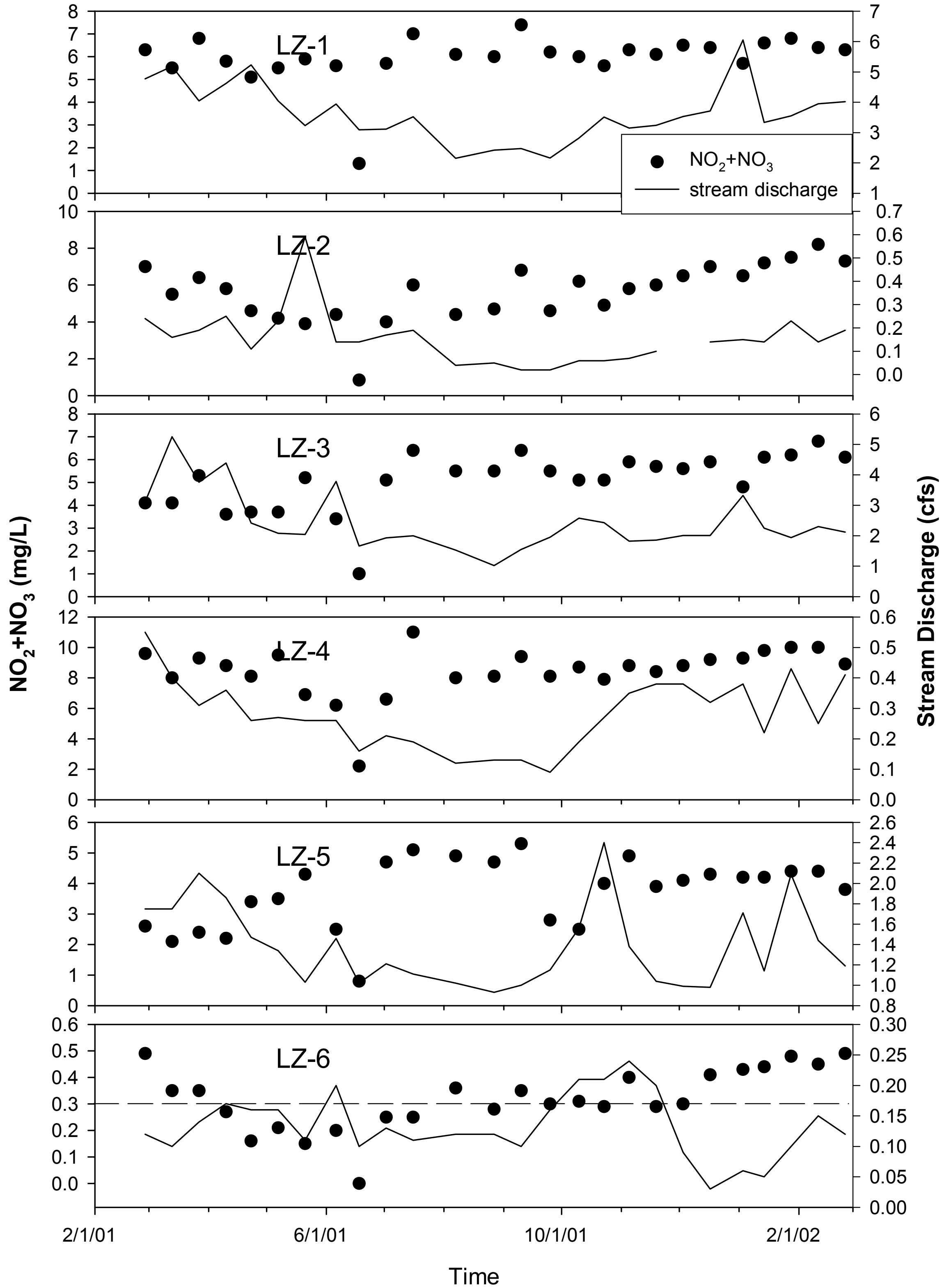

Figure 8. Nitrate+Nitrite concentrations plottled with stream discharge for IASCD Lindsay Creek monitoring stations from Feb 27, 2001 to Feb 25, 2002.

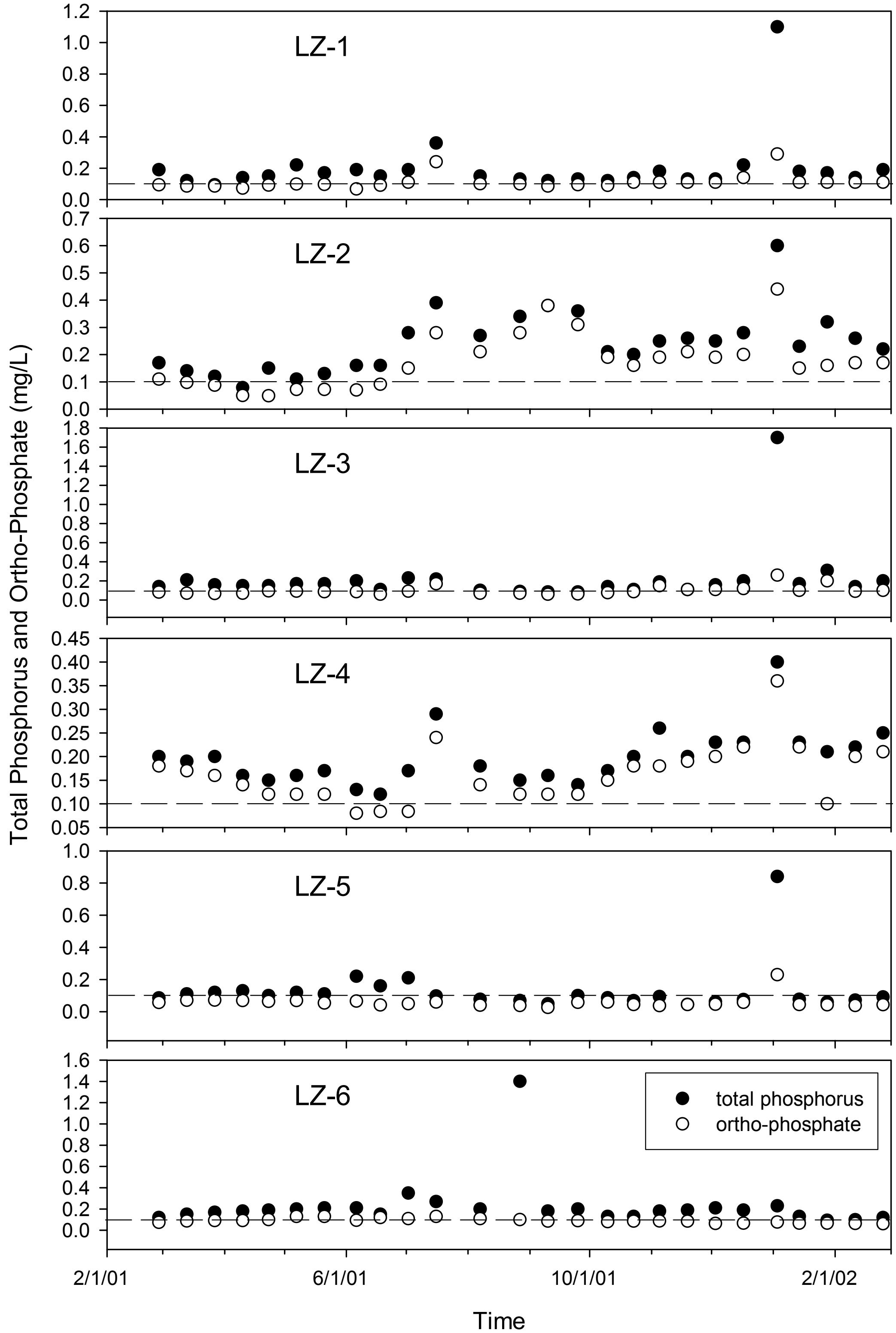

Figure 8. Total phosphorus and ortho-phosphate concentrations for IASCD Lindsay Creek monitoring stations collected from Feb 27, 2001 to Feb 25, 2002.

0.2 mg/L) with the exception of one event that equaled 1.4 mg/L in late September (Figure 8). Significant positive correlations ($p<0.05$) were observed between TSS and Turbidity versus Total Phosphorus at all mainstream sites (LZ-1, LZ-3, LZ-5, and LZ-6), which suggests that at least some phosphorus is being mobilized by the release of sediment at these locations. However, TSS concentrations, except for one or two exceptions remained well within acceptable boundaries (Figure 6, Table 3). At sites LZ-2 and LZ-4 the data suggest that phosphorus is entering the water column from observed cattle and horse grazing (ranchettes) and possibly from septic system failures.

Bacteria (*E. coli* and fecal coliform)

The standard for *E. coli* is that concentrations should not exceed 126 organisms/100 mL, which should be based on a geometric mean. The *E. coli* standard for primary contact is not to exceed 406 organisms/100 mL at any time and not to exceed 576 organisms/100 mL at any time for secondary contact. The standard for fecal coliform states that water samples should not exceed 500 organisms/100 mL at any time for primary contact and should not exceed 800 organisms/100mL at any time for secondary contact. All Lindsay Creek monitoring stations had several events where bacteria levels for *E. coli* and fecal coliform greatly exceeded the recommended standards (Figure 9, Table 3). Bacteria levels at site LZ-2 was over 16,000 organisms/100 mL for 54% of the events sampled (Figure 9). At this location the lack of city sewer and potential private septic failure could be possible explanations of such extremely high values. There are a few ranchettes along this tributary that pasture horses with direct access to the stream, which also could be potential contributors. Site LZ-3 was severely elevated (> 16,000 organisms/100 mL only during summer months (Figure 9). This site was positioned directly below a large animal feeding operation and cattle were only present during summer months, which seem to correspond to the observed spikes (Figure 9). There are some small ranchettes positioned above the feedlot, which could be possible contributors to bacteria levels at LZ-3 (Figure 9). Bacteria levels at LZ-4 were only elevated from mid-June to late July with the remainder of datapoints falling at or below the criteria (Figure 9, Table 3). Bacteria concentrations at site LZ-5 averaged 667 organisms/100 mL for fecal coliform and 494 organisms/100 mL for *E. coli* (Table 3). Site LZ-6 averaged 982 organisms/100 mL for fecal coliform and 928 organisms/100 mL for *E. coli* (Table 3).

Conclusions

The monitoring program for Lindsay Creek was successfully carried out as planned. Protocols were followed, QA/QC standards were met, and specific information per TMDL parameter for each subwatershed was collected. All measured values for dissolved oxygen, water temperature, and pH were all observed to be within the acceptable range of standards during the monitoring period. With the exception of one isolated event, very little sediment entered Lindsay Creek from agriculture during the monitoring period. Significant positive correlations were observed between TSS and Turbidity versus Total Phosphorus at all mainstream sites (LZ-1, LZ-3, LZ-5, and LZ-6), which suggests that at least some phosphorus is being mobilized by the release of inorganic sediment at these locations. However, TSS concentrations, except for one or two exceptions, remained well within acceptable boundaries. At sites LZ-2 and LZ-4 the data

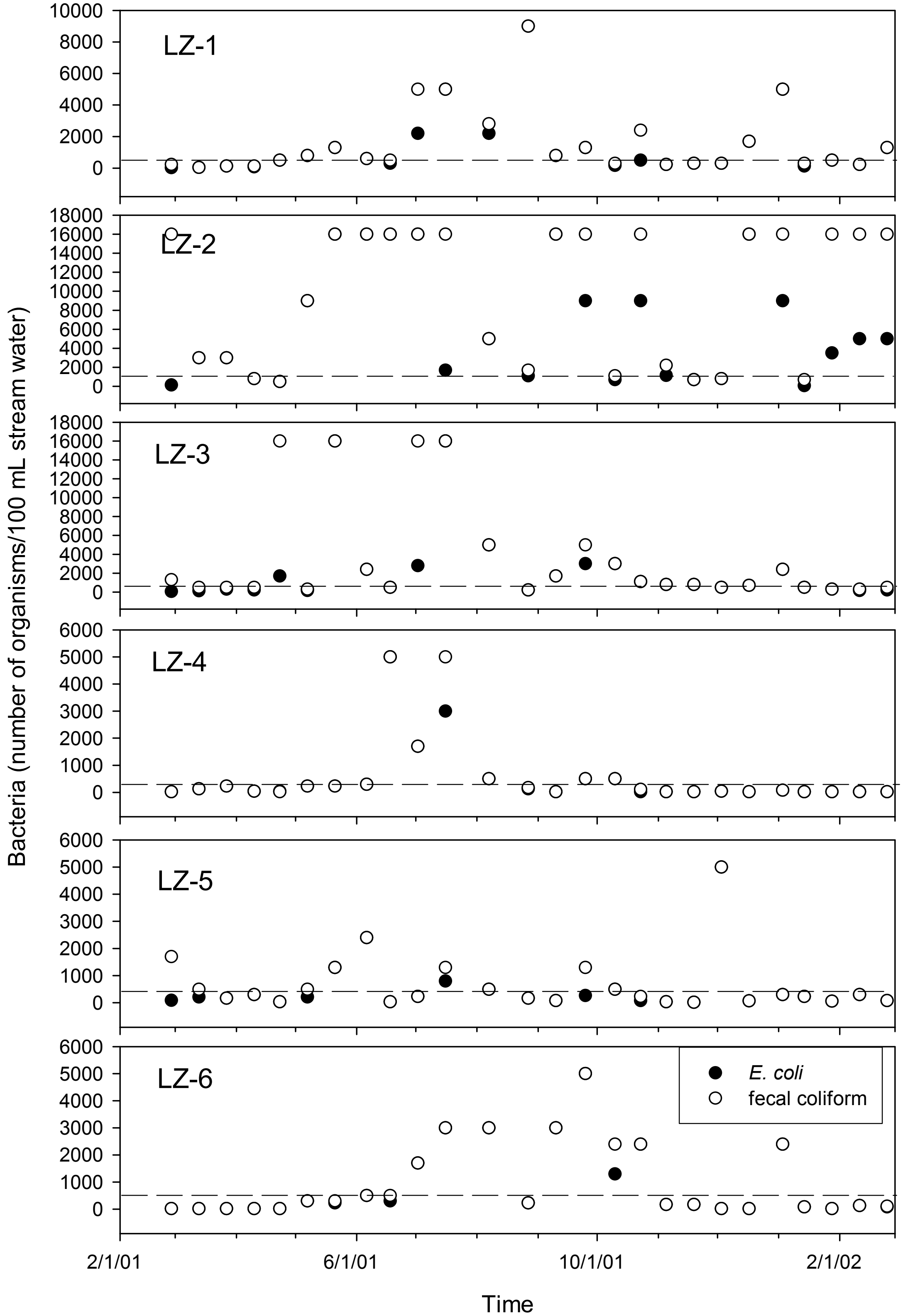

Figure 9. Fecal coliform and E. coli concentrations collected at IASCD Lindsay Creek monitoring stations from Feb 27, 2001 to Feb 25, 2002.

suggest that phosphorus is entering the water column from observed cattle and horse grazing and/or possibly from septic system failures.

Nitrate+Nitrite concentrations at Lindsay Creek were extremely high during the collection period. Site LZ-2 seems to be a major contributor with NO_3+NO_2 values averaging just below 6 mg/L. The LZ-2 tributary parallels Lapwai Creek Road. Lewiston City sewer services do not extend to that area, which indicates that private septic systems are all that are available to residents. The high NO_3+NO_2 concentrations at this site suggest that septic systems could be failing in this area. Also, ranchettes with horses could potentially be contributing. Nitrogen concentrations at LZ-3 seem to be acting as a conduit for nitrogen entering from the LZ-4 and LZ-5 subwatersheds. Baseflow in Lindsay Creek is supported almost entirely from groundwater upwelling. Sites LZ-4 and LZ-5 are located downstream of the most significant upwelling zones. There are only two private residences on both of these watersheds and it would be unlikely that this number of homes could contribute to these high values. These data suggest that NO_3+NO_2 is entering Lindsay Creek through the groundwater. Another possible explanation of these high NO_3+NO_2 concentrations is that nitrogen based fertilizer could be applied to crops and then enters the groundwater. The data do not support this because there would be some portion that would flush during high flows and show peaks in the surface water (especially LZ-2, LZ-5, and LZ-6). No peaks or spikes were observed in nitrogen at any Lindsay Creek site during the monitoring period.

The DEQ has identified Lewiston as being an area of concern with nitrates in groundwater. This monitoring program identified nitrates and bacteria as the most serious water quality issue affecting the surface water as well. Many improvements were made to the large animal feeding operation located on Lindsay Creek during the monitoring period such as excluding cattle from the stream in most areas. Sediment levels were maintained at low levels, but high bacteria levels at certain times during the summer were observed below this operation.

Recommendations

I recommend that city officials evaluate current conditions of the city sewer system and take action to ensure that contaminants are not leaking into the ground water. Lewiston City official should work with State ground water experts to identify if or where a problem exists and to take necessary action to alleviate any problems that are found. The NPSWCD board members and NRCS personnel should educate local landowners and operators how and when to cultivate in the most optimal times of the year to reduce erosion. Cattle operators should work with the NPSWCD, NRCS, ISCC, and ISDA to develop a cattle waste management plan in this area. In addition alternative forms of watering such as siphon systems could further reduce contact of cattle with Lindsay Creek.

Future monitoring on Lindsay Creek should focus on nitrogen and bacteria. The exact source of nitrate and nitrite into the groundwater needs to be determined. Efforts should focus on city sewer, private septic systems, grazing, and fertilizer application. The City of Lewiston should be responsible for monitoring the condition of municipal sewer systems that appear to be leaking into the groundwater. The State should conduct well monitoring in this area to help protect water quality in the ground water. Further concurrent study and comparison of surface water and ground water should be made in this area. The DEQ and health district should monitor the condition of private septic systems and educate local residents to available options and programs that are available (Home*A*Syst and Farm*A*Syst). Bacterial DNA testing would be able to pinpoint whether the extremely high bacteria levels are coming from humans, cattle, horses, or wildlife and in what proportions.

References

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